CHASSIS Lubricate for SAFETY every 1,000 MILES LUBRICATION

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*Steering Gears**

DESIGN, ADJUSTMENT AND LUBRICATION ENGINEERS KEEPING PACE WITH SAFETY REQUIREMENTS

By George Bissett, Gemmer Manufacturing Co., Detroit, Mich.

Probably no group of engineers in the automotive industry has contributed more towards safe operation of present day cars and trucks than have the designers of steering gears. Yet few drivers give any particular thought to this important unit until some unusual incident occurs, calling it to their attention.

Before the advent of our many thousands of miles of hard surfaced highways, a 100 or 200 mile trip on rough dirt and mud roads was a real task for the man back of the steering wheel. Arms would be aching and sometimes practically numb from the road shocks transmitted to the steering wheel. As roads were improved, speed on the highways increased, and not only was there a problem of designing steering gears so that road shock and vibration would be eliminated, but also there was the need of reducing steering effort on the part of the driver so that easier, quicker and definite control of the car could be maintained.

Few operators of cars or trucks realize that present designs of steering gears are manufactured with the precision of a fine watch. Adjacent parts are ground, lapped and polished to a point where friction is reduced to a minimum. Adjustable roller bearings of ample size are used, and ratios between gears have been established, reducing steering effort on the part of the driver. Quick and easy operation of these units promotes safety on the highways.

Engineers have now so perfectly designed these units that we now see such expressions as "finger tip control," meaning that the car can be easily steered at normal speed by the pulling effort of one finger.

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While all steering gears are similar in their purpose, there are several different types. In the Worm and Sector type, shown in Illustration "A," the lower end of the steering column is provided with a worm thread which mates with teeth cut into a three tooth Sector, mounted on a cross shaft supported by bushed bearings which extend through the steering gear case, and on the end of which is mounted an arm or lever. This lever in turn connects to the steering rods operating the front wheels.

The worm at the lower end of the steering column mates with teeth cut into a roller mounted on the cross shaft, thus having a rolling contact, reducing the friction. This construction is known as the "Worm and Double Roller Type."

Still another construction which is used on heavy trucks, tractors, and road machines, is designed with three teeth on the roller contacting the worm on the lower end of the steering column. This is known as the "Worm and Triple Roller Type." Having the three teeth in contact with the worm increases the bearing area, thus reducing friction per square inch of contact surface, and making the steering effort still less.

All these various types are made in different sizes so that they are adaptable for use in the lightest cars or the heaviest trucks and other equipment.

Adjustments

Means have been provided to eliminate all play within the steering mechanism. There is no need of being forced to choose between a stiffly operating unit and one having lost motion. None of the adjustments are indexed, but can be set at the most desirable point at the will of the adjuster.

Before making any adjustments, jack up the front wheels of the car or truck and make sure that cause of complaint is not from some other looseness, such as ball sockets, or end play in cross shaft.

Adjusting Worm Shaft Bearings

(Worm and Sector Type)

In the Worm and Sector type gear, an automatic take-up device between the upper worm thrust bearing and the housing cap is used to eliminate the need of adjustment of the worm bearings, except perhaps after considerable usage. Shims are also provided between the top of the case and the collar to facilitate additional adjustment if necessary.

Editor's Note: Complete instructions for adjustments of worm shaft bearings, proper mesh of sector teeth in worm, and centralization of tooth contact are too lengthy to include in this article. These instructions, as well as any other information regarding the servicing of all types of Gemmer Steering Gears are available to interested parties by addressing the manufacturers.

Adjusting End Play in Sector Cross Shaft

See that housing cover nuts A and jam nut E are tightened SECURELY. Turn hand wheel to either extreme and back an eighth of turn. Gripping ball arm at hub, shaft should rotate freely without a par-

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*Car Manufacturers' Latest Recommendations**

Lubrication recommendations and procedure are constantly being altered by the car manufacturers as a result of changes in production or because of service experience in the field. Enjoying close cooperation with the automobile manufacturers at all times, we provide the latest information by means of these Bulletins.

CHRYSLER PRODUCTS, ALL 1939 UNITS—A "seasonal" change of transmission lubricant is recommended by the manufacturers of the various Chrysler units (Chrysler, De Soto, Dodge and Plymouth). This means that in localities where definite Summer and Winter temperatures are encountered, it is necessary that a lighter grade of lubricant be used for Winter operation because of the possibility of experiencing trouble in shifting gears if the transmission lubricant is too heavy.

In southern localities, New Orleans for example, where temperatures below +32 deg. F. seldom if ever are encountered, it is now recommended that the transmission lubricant in Chrysler products be changed at regular intervals of 15,000 miles.

DODGE 6 (D11)—1939—A change has been made in the construction of the front wheel lower control arms. With the new construction, the front fitting on the lower spindle support has been eliminated. Cars will now be found in the field with either one or two fittings for lubrication of the lower spindle support.

FORD V-8 (60, 85 AND DE LUXE) AND MERCURY 8—1939—Starting in April, a change was made in production on all 1939 Ford passenger car models, eliminating the pressure gun fittings for lubrication of rear wheel bearings. On models not equipped with fittings, rear wheels are to be lubricated every 5,000 miles by removing the wheel and cleaning and repacking the bearings with Wheel Bearing Grease. On models produced previous to April, the rear wheel bearings are to be lubricated with Wheel Bearing Grease through fittings every 1,000 miles.

HUDSON 6, 8—1939—In the April issue of the Bulletin we covered shock absorber equipment on 1939 Hudson models. In this article we stated that all models with the exception of the Country Club 6 are equipped with Monroe, telescoping type. This should have read "Country Club 6 and 8"; as both the Country Club 6 and 8 have Delco, telescoping type shock absorbers.

NASH 6, 8, LAFAYETTE—1939—The manufacturer has recently announced a change in the recommended differential lubricant capacities for hypoid rear axles on 1939 models. The latest recommended capacities are as follows:

All *hypoid* rear axles on the 3910 and 3920 Series cars require 4 pt. or lb. and on 3980 Series cars require 5 pt. or lb. For *coupes using spiral bevel gears,* the recommended capacities are: 4 pt. or lb. on 3910 and 3920 Series cars and 6 pt. or lb. on 3980 Series cars.

Regarding the above mentioned *coupes with spiral bevel rear axles,* the manufacturer's original intention was to produce a limited number of these models. However, this arrangement of axles worked out so successfully that they have continued to use spiral bevel rear axles in coupe models and expect to continue to do so in the future. Hypoid Gear Lubricant SAE 90 is recommended for these axles, the same as for the Hypoid rear axles used in the other models.

The Nash factory informs us that some trouble has been experienced with the differential lubricant pumping out through the vent located on top of the housing near the pinion end, in cases where the vent tube has not been properly inserted. To avoid this leakage, it is necessary that the long end of the vent tube be located against the oil flow from the ring gear so that the opening is on the low pressure side.

To insure correct location the relation between the tube and the vent should be determined by locating the cotter pin in the cap and tube with the head of the cotter pin in line with the long end of the diagonally cut tube. Then when the vent is installed in the axle it should be firmly tightened in position with the cotter pin at an angle of 45° to the center line of the axle and its head toward the center line of the axle.

Previous to April 1, 1939, king pins on all 1939 Nash models were provided with two oilers at each king pin. Starting April 1, the lower king pin oilers have been discontinued, due to the possibility of water entering. These oilers have been replaced by pressure gun fittings through which Chassis Lubricant should be applied every 1,000 miles. The upper king pin oiler has been retained and should be lubricated with Engine Oil every 1,000 miles.

OVERLAND 39—1939—Effective approximately April 1st, Willys-Overland Motors, Inc., has changed the name of these models from "Overland" to "Willys-Overland."

When 1939 models were first announced the manufacturer intended to make the Overland the principal item of the line and to eventually drop the Willys name. However, this new factory decision will bring all these models back under the name "Willys-Overland."

The Overland 39 Standard model is now known as the Willys-Overland Speedway. The Overland 39 De Luxe model is now known as the Willys-Overland De Luxe. The recently announced new model is known as the Willys-Overland Speedway Special.

The new Speedway Special includes equipment generally associated only with De Luxe models but sells at a standard car price. Tire sizes and pressures are the same as for the De Luxe model. Lubrication recommendations and details are identical with those for early 1939 production.

The manufacturer has recently issued new instructions regarding the frequency of changing the oil used in the engine crankcase. The new instructions are as follows:

Renew the Engine Oil after first 500 miles and again at 1,500 miles. Thereafter, during warm weather operation, change the oil every 2,500 miles. For Winter operation, change the oil every 2,000 miles.

PLYMOUTH P7, P8—1939—A change has been made in the construction of the front wheel lower control arms. With the new construction, the front fitting on the lower spindle support has been eliminated. Cars will now be found in the field with either one or two fittings for lubrication of the lower spindle support.

STUDEBAKER, ALL MODELS—Studebaker has amended previous instructions for draining the crankcase on 1939 models as follows:

Recommendations for the Champion model are: Drain after first 500 miles, then at 1,500 miles, and thereafter every 2,500 miles.

Recommendations for 1939 President and Commander models differ somewhat—they are: Drain after first 500 miles, then at 1,500 miles, and thereafter every 2,500 to 3,000 miles. These recommendations have been made retroactive for all previous Studebaker models.

Studebaker qualifies the above recommendations as follows:

"Engine oil should be changed at the end of the first 500 miles and again after the first 1,500 miles of car operation. After this period the oil should be changed regularly, the frequency depending on the condition of the oil as affected by operating and atmospheric conditions.

"Under average driving conditions (10,000 to 12,000 miles per year) it will usually be satisfactory to change oil four times yearly. Seasonal changes can ordinarily be made at the regular draining periods.

"Operation under severe dust conditions will result in contamination of the oil and

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the oil should be changed more frequently. Drainage periods will depend on the severity of the conditions and no definite mileage can be given.

"Short runs in cold weather with frequent stops and starts, increase the possibility of crankcase dilution because the engine does not reach normal operating temperature. The oil should be changed more frequently under these conditions.

"The oil pan should be removed from engine and thoroughly cleaned out once each year, preferably in the spring at the time of changing from Winter to Summer grade oil."

New Convertible Sedan Added to Plymouth Line

Plymouth has recently announced the first convertible sedan to be offered in the Plymouth line. This new model is the largest 5-passenger model in the 1939 Plymouth line and is the super-luxury model of its price class.

The new model is built with a 117-inch wheelbase, affording great roominess in both front and rear compartments. The special body has a double frame for extra strength. Improved support arms that fold inward make it a simple matter to raise or lower the top.

The standard Plymouth engine is used in the new model and the chassis design is the same throughout as on the P-8 model. Capacities for all units, and lubrication details are the same as on the P-8 model. No special set of serial numbers has been assigned to this new model; serial numbers for the P-8 will apply.

New Hupp Skylark

The new Hupp Skylark will likely have made its appearance by the time this bulletin is published. Complete lubrication and other details have been secured and will be ready for release just as soon as factory approval has been secured and a personal inspection of the car has been made.

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ticle of end play. Adjust as required by means of adjustment screw at side of housing next to motor. Be sure to lock SECURELY with lock nut and reinspect end play and freedom.

Adjusting Worm Shaft Bearings

(Worm and Roller Types)

Before making worm shaft bearing adjustments on Worm and Roller type steering gears make the following inspection:

Turn hand wheel about one turn to right from straight ahead driving position. Secure in this position to prevent any oscillation when front wheels are shaken violently. This can be done by tying one spoke to a left side door column and holding the wheel against it as a brace. Grip column with other hand just below hand wheel hub with side of finger barely touching lower end of hand wheel hub. Have helper shake front wheels hard sidewise. This will enable any end play in worm bearings to be felt at wheel hub. If any end play exists, worm bearings need adjusting. Be sure *end play* is present and that it is not confused with play or give in the jacket bushing.

On all Worm and Roller type gears, the rollers of which may be either double or triple roller type, the worm adjustment is accomplished with the use of shims found at the bottom of the case between the case and the worm cover. Loosen the worm cover by releasing the 4 cap screws ⅛". Use a knife to separate shims, passing blade all the way round between shims so as not to mutilate them. Remove only one shim at a time, repeating the operation, if necessary, until correct adjustment is obtained.

Worm Shaft and Double Roller Mesh Adjustment

The adjustment for closer mesh of the shaft roller with the worm is accomplished by an outside roller shaft adjustment screw.

The position of roller contact with the worm is offset from the center line of the worm, hence when screw is tightened the roller is moved into closer mesh with the worm.

To adjust, remove roller shaft adjustment screw lock nut, slide off lock plate far enough to clear lock boss on roller shaft cover. Be sure hand wheel is located in mid-position of wheel turns, or straight ahead driving position, and drag link previously disconnected. Tighten roller shaft adjustment screw just enough to remove play between roller shaft roller tooth and worm.

Check this by amount of play felt at end of ball arm. It is better to leave a slight amount of play at this point than to tighten too much.

When tightened beyond the point of taking up lash, serious results will occur that are a detriment to continued good steering gear results.

Slide lock plate in position against roller shaft cover and in locked position. Replace Roller Shaft Adjustment Screw Lock Nut and tighten.

Worm Shaft and Triple Roller Mesh Adjustment

The method of adjusting the Worm and Triple Roller type of steering gear for closer mesh of the shaft roller with the worm is different than that used on the Worm and Double Roller type.

To adjust, be sure that the hand wheel is located in mid-position of wheel turns, or straight ahead driving position, and that the drag link has been disconnected. Remove roller shaft adjustment lock nut plate and nut, slip off U-shaped shaft thrust washer and one shim. (Note there are two thicknesses of shims to permit close adjustment). Select the proper amount of shims to take out all play in this position without increasing the pull at hand wheel rim more than one pound over what it was when there was play between worm and roller in this center position. It is better to leave a slight amount of play between roller and worm than to set up a tight adjustment by removing too much shim.

Lock nut must be tightened securely to prevent rotation of shims and thrust washer. (Note there are four different locking positions obtainable by reversing adjusting nut lock plate.) Select position that will leave adjustment nut tightened securely and replace lock washer and stud nut.

Lubrication

Remove oil filler plug in top of steering gear housing; fill with a Fluid Gear Lubricant, seasonal grade, manufactured by reputable oil refiners. A vent hole is provided to allow air to escape as the unit is filled. Avoid the use of graphite, white lead or heavy solidified oils or greases, which are sometimes resorted to in older, leaky units to overcome leakage of the lubricant. Inspect the lubricant level at frequent intervals and keep the case full. Due to "drag" of heavy oils in winter weather, a lighter grade may be used if desired. However, before going to a lighter grade of oil to correct hard steering, make sure that some mechanical trouble is not responsible for the condition.

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*Wheel Bearing Lubrication**

1. Use the Lubrication Chart.

2. A broken bearing helps tell your story.

3. A front wheel tool kit saves time and trouble.

4. The new Cap-Pul tool makes full-length discs a cinch.

Hidden services are harder to sell because they tax the customer's imagination. But wheel bearings that fail seldom give warning. That is why we must make the customer understand that front wheel bearing lubrication is important.

When the customer can get a glimpse inside the hub he understands front wheel lubrication and a customer who understands doesn't have to be sold—HE BUYS.

Invite the customer to watch the wheel packer work. Let him see for himself how completely the new grease coats the bearing parts.

The average lubeman with a determination to follow instructions, can do an excellent front wheel lube job. A few fundamentals must be covered if the job is to be of professional calibre.

When a wheel is pulled, everything should be in readiness. Your tools should be kept in a practical tool kit. Spread the fender cover and a clean cloth for the bearings; have a container with clean kerosene at hand. When all these preliminary details have been completed start to pull the hub caps.

As each part is removed, wash it thoroughly, blow out excess kerosene and inspect carefully. Inspection is one of the most important steps in the job. A defective bearing part, a cracked race, or pitted bearing might cause a serious accident. You do your customer a real favor if you protect him from this danger.

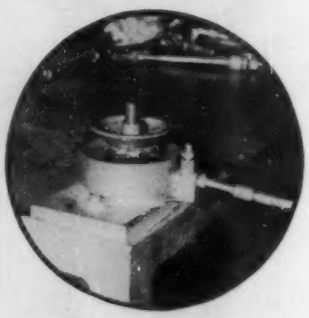
Make it a habit to wipe the assembly entirely clean. Get rid of the old lubricant but be mighty careful of the brakes. Grease or kerosene on the linings will cause plenty of trouble; will probably undo all the good an expert lube job has accomplished. A drop of oil on working parts of the brake mechanism is Okay. In fact it's desirable, but again the same caution applies—a drop is enough.

Carefully replace the assembly and tighten until the bearings bind slightly, reverse nut one cotter key hole and give the wheel a test spin. If it rotates freely, insert a new cotter key and bend legs of key over nut and end of spindle. No job is complete until all dirt and finger prints have been removed from hub cap and wheel.

Clean and replace your tools and everything is all set for the next job.

* Courtesy "The Sohio Sales Engineer."

5. It pulls the inner cap, too.



6. The bearing packer is a true "professional."

7. The Cap-Pul puts the cap on evenly.

LUBRICATE FOR SAFETY EVERY 1000 MILES